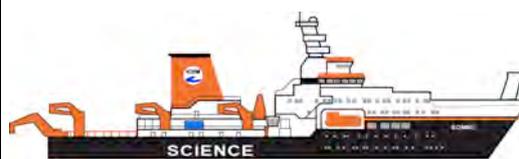




SO-249 Leg 2

BERING

Weekly Report No. 8
(25.07. – 31.07.2016)



R/V SONNE

55°10'N / 168°00'E

At the beginning of the third week of the second leg of R/V SONNE cruise SO-249 we finished the investigations in our northernmost working area, the Chukotka-Beringia Margin. While multi-beam mapping revealed interesting fault systems, which may be related to right lateral strike-slip fault at the boundary of the Beringia and North American Plate, unfortunately, dredging of these structures did not yield magmatic rocks. En route to the Beta Rise in the western part of the Komandorsky Basin, we took four dredges on some dome-shaped features located at the western flank of Shirshov Ridge. Previous studies, among them those conducted on KALMAR expedition SO-201-2, indicated that an ophiolite complex may exist in this part of the ridge. SO-249 sampling in this area was very successful and recovered a variety of rocks types including harzburgites, dunites, orthopyroxenites, basalts, dolerites, and partially amphibolitized gabbros. This rock suite represents a cross section through the oceanic lithosphere and not only confirms the observations made on SO-201-2 but also makes it possible to gain new insights in the enigmatic nature and evolution of the Shirshov Ridge and so the geodynamic history of the Bering Sea.

On Tuesday, July 26th, R/V SONNE approached the area north of the Beta Rise, which is characterized by a distinct heat flow anomaly. Our studies in this area aimed to test the idea that this anomaly may be associated with recent volcanism. It appears, however, that this is not the case or that if there has been volcanism, its extent has been limited. Apart from the few already known bathymetric highs, we discovered three additional features, all relatively small, up to only 500 m high. It is unclear if these represent young volcanic edifices or tectonic structures. Our dredge recovered basalt fragments from one of these structures. Geochemical analyses of these rocks may help to clarify the origin of these features.

Subsequently, we sailed along the Alpha fracture zone to the Volcanologists Massif, on which Piip volcano, the westernmost active volcano of the Aleutian Arc, is located. This complex represents a key area for the reconstruction of temporal and geochemical variation of the magmatism along the Aleutian Arc and of magmatic processes in an area of highly oblique subduction. The Volcanologists Massif and Piip were studied during various Russian expeditions and on SO-201-2. However, major sections of this large complex have not yet been mapped at high resolution or sampled for geochemical studies. We decided to fill these gaps because of the importance of Volcanologists Massif and Piip for the understanding of magmatic processes in the western Aleutian Arc. Mapping and sampling focused on a tilted block northwest of the Volcanologists Massif, its largely unstudied eastern base and the upper portions of Piip, which appear to be three, coalesced cones. The combined bathymetric surveys of SO-201-2 and SO249 leg 2 have produced the first high-resolution map the Volcanologists Massif including Piip, which provides important information about the tectonic and volcanic structures of this complex. Dredges conducted on the upper slopes of Piip delivered mainly andesitic lava and large quantities of dacitic pumice. At the Volcanologists Massif we dredged a wide variety of rock types, dominated by olivine, clinopyroxene, and plagioclase phyric pillow lava. The lava fragments show frequently fresh glassy margins. Volcanic glass forms by rapid cooling of lava for example when hot lava comes in contact with water. Such glass is of particular interest to study the original composition of melts and their pre-eruptive volatile contents. Volcanic glass, however, is not stable and alters over the course of time; initially to palagonite and finally to clay. This process is accelerated when glass is exposed to seawater. Therefore it is a great achievement that we have sampled large amounts of fresh glass at several sites of the presumably oldest units of the Volcanologists Massif.

Due to the significant structural as well as bathymetric differences between the habitats sampled during this week, the diversity of the animals brought up in our dredges was relatively high. While primarily organisms inhabiting mud or loose sediments were found in the Alpha, Beta, and Gamma Fracture Zones, the rocky habitats surrounding Piip Volcano

were characterized by species adapted to this environment. A number of small and large animals were caught during the eighth week of our cruise. A selection of the most interesting is shown here. Some relatively large sea spiders (Pycnogonida), a group of chelicerates (Chelicerata), was caught completely intact near the Beta Fracture Zone (see photo). Near the Alpha Fracture Zone, we obtained eggs as well as juvenile and adult representatives of the Incirrata (see photo), a group of octopuses (Octobrachia). The striking structural diversity of sea cucumbers (Holothuroidea) is particularly well illustrated by two specimens dredged near the Alpha Fracture Zone and Piip Volcano, respectively (see photos). The animal taken from over 3,000 m depth is a representative of the group of sea cucumbers known as sea pigs, which typically inhabit muddy sea floors. In contrast to this rather delicate animal, the second specimen with its dorsal shields indicates adaptation to a rocky habitat.

After completion of the studies in the Piip area, R/V SONNE headed to a chain of small enigmatic structures that appear to emanate from the Volcanologists Massif in southeastern direction. Afterwards we will focus on the Komandorsky block in order to get insights into the inception and early history of the Aleutian Arc.

For the first time since sailing from Dutch Harbor on June 6th, we had a long period, while in the Bering Sea, of sunny weather, clear sky, and relatively warm air temperatures of up to 18°C. The crew and scientists enjoyed this very much after the interminable and dreary fog of the Aleutian Islands. All participants are well and send greetings from the southwestern Bering Sea to everyone at home.

Reinhard Werner (chief scientist SO249 Leg 2) and the cruise participants



A full dredge promises a lot of work but is also a big success in most cases.



Scientists collect samples from the dredge while they are observed by an interested audience.



R/V SONNE off the coast of Kamchatka. This week we experienced that the weather in the Bering Sea can also be very nice.

Photos taken by Stepan Krasheninnikov



This large sea spider - or pycnogonid - was collected intact from about 3,400 m depth near the Beta Fracture Zone. On one of its legs sits a small crustacean, an amphipod. (Alexander Ziegler)



One of the several, ghost-like octopuses collected in over 2,500 m depth near the Alpha Fracture Zone. (Alexander Ziegler)



This charismatic sea cucumber, a member of the Elpidiidae, is colloquially known as the sea pig - the animal was collected from about 3,100 m depth near the Alpha Fracture Zone. (Alexander Ziegler)



Although shaped quite different from the sea pig shown on the left, the animal pictured here is a sea cucumber as well. This specimen, a member of the Psolidae, was taken on Piip Volcano at about 700 m depth. (Alexander Ziegler)